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Atomic Structure and Properties
Unit 1 ↓

- Conversions - Avogrado's number, molar mass, and mole ratios
- Empirical+Molecular Formula - These are the simplest whole # ratio of atoms for a compound and the chemical formula for a compound, respectively.
- Mass Spectroscopy - Mass to charge ratio of compounds.
- Electron Configurations - Electrons fill the lowest energy level orbital first, no two e- can have the same spin, and e- occupy separate subshells before sharing one.
- Photoelectron Spectroscopy - Measures the amount of energy electrons release.
- Periodic trends - recognizing them and explaining them
- Mixtures **-** Homogeneous (pure) and heterogeneous

Molecular & Ionic Compound Structure and Properties
Unit 2 ↓

- Ionic Bonds - between metal and nonmetals, e- are transferred.
- Covalent Bonds - between nonmetals, e- are shared.
- Lattice Energy - energy of ionic bonds.
- Metallic Bonds - The **sharing** of free e- between metal atoms.
- Alloys - Compounds of different metals
- Lewis Structures and VSEPR - Bonding diagrams and geometric, 3-D shapes of compounds.
- Hybridization - atomic orbitals fuse to form new orbitals
- Formal Charge - Charge of an element in a molecule.
- Resonance - Molecules bonding structure is a combination of other possible structures.
- Coulomb's Law - shorter distances + higher charges = strongest attractions

Intermolecular Forces & Properties
Unit 3 ↓

Strongest to Weakest IMFs:

- Ion-Dipole - ionic compounds + liquid
- H-Bonds - fluorine, oxygen, nitrogen
- Dipole-Dipole - between two polar molecules (polar=asymmetrical)
- LDFs - exist in every sample.
- Bulk Scale Properties - Melting Point, Boiling Point, Viscosity, etc.
- Types of Solids
- Kinetic Molecular Theory - gas particles: (1) are far apart (2) are in constant motion (3) collide elastically (4) do not attract or repel each other (5) average k.e. = temperature
- Ideal Gas Law - $PV = nRT$
- Solutions - "like dissolves like"
- Beer's Law - $A = abc$ represents the change in light's energy as it passes through a material.
- Photons, wavelength, frequency, and energy - Photons carry energy in waves; $E = h\nu$ and $c = \lambda\nu$.

Chemical Reactions
Unit 4 ↓

- Limiting Reactant - compound that runs out during the reaction, stopping it.
- Writing Net Ionic Equations - Net ionic equations remove spectator ions to show the species that actually interact in a reaction.
- Combustion Reactions - Hydrocarbon + $O_2 \rightarrow H_2O + CO_2$
- Redox Reactions - Transfer of **electrons**.
- Acid-Base Reactions - Transfer of **protons**.
- Precipitation Reactions - Formation of insoluble solids.
- Stoichiometry - Mole conversions to predict amounts of products or reactants.
- Titrations - Finding an **equivalence point** for acid-base reactions.

Kinetics
Unit 5 ↓

- Rates of Reaction - The rate at which reactants turn into products.
- Rate Laws - Relates to the concentration of reactants and the reaction order.
- Integrated Rate Laws - Time affects concentration of a reactant.
- Collision Theory - Particles must collide in the **right orientation** with **enough energy** to carry out a reaction. The faster this happens, the faster the reaction rate is.
- Reaction Mechanisms - Elementary reactions that describe steps in a reaction.
- Rate Determining Step - The slowest step of the reaction. Limits reaction.

Thermodynamics
Unit 6 ↓

- Specific Heat - energy required to raise the temperature of 1g of a substance by 1°C.
- Enthalpy of Reaction - ΔH, the amount of heat absorbed or released by a reaction.
- Calorimetry - Experimental way to measure the enthalpy of reaction ($q=mC\Delta T$)
- Hess's Law - The total enthalpy of reaction is a sum of the enthalpies for each step.
- Enthalpy of Formation - The change in enthalpy of forming 1 mole of a compound.
- Bond Enthalpy = Σ energy of bonds broken - Σ energy of bonds formed

Equilibrium
Unit 7 ↓

- Equilibrium Condition - Forward rate = reverse rate and concentrations are constant.
- Equilibrium Expression and Constant - Ratio of products to reactants at equilibrium.
- ICE Tables - Calculate equilibrium concentrations or pressures.
- Reaction Quotient - Ratio of products to reactants at any point in the reaction.
- Solubility Product - Ratios/products of soluble compounds. Na, K, NH_4^+, and nitrate salts are soluble in water.
- Le Chatelier's Principle - Reactions counteract changes the system in order to maintain equilibrium.

Acids and Bases
Unit 8 ↓

- Acids - produce H+; H+ donors
- Bases **-** produce OH-; H+ acceptors
- Common Formulas - $pH = -\log[H_3O^+]$, $pOH = -\log[OH^-]$, $pH + pOH = 14$, $[H^+][OH^-] = K_w$.
- Acid and Base Dissociation Constant: If less than 1, reaction favors the reactants. If greater, favors products.
- Strong Acids + Bases - completely dissociate into ions in water
- Percent Dissociation - change in concentration / initial x 100
- Buffers - occur between weak substances and their conjugates, they resist drastic changes in pH
- Henderson-Hasselbalch Equation
- Titration Curves - pH v volume of titrant added
- Equivalence Point - $pH=pK_a$, [HA]=[A-]

Applications of Thermodynamics
Unit 9 ↓

- Entropy (ΔS) - disorder
- The amount of entropy will always increase over time.
- Gibbs Free Energy (ΔG) - Available energy that can be converted into work
- Spontaneous = $-\Delta G$ = Thermodynamically favorable
- $\Delta G = \Delta H - T\Delta S = -RT\ln K$
- Voltaic Cells - spontaneous reactions, cell potential must be positive
- Standard Cell Potential (E°) - potential energy difference between electrodes in volts..
- Salt Bridge - balances charge
- Electrolytic Cells - requires an outside energy source($I = q/t$).
- 1 volt = 1 J / 1 coulomb
- $\Delta G = -n\mathcal{F}E°$

Additional Information

Content Good to Memorize:

- VSEPR chart
- Polyatomic ions
- Equations not on the reference table
- Strong acids and bases
- Unit conversions
- Solubility rules
- Kinetics - integrated rate laws
- Kinetics - units of K based on order of reaction
- Relationship between ΔG, ΔH, and spontaneity

AP Format

- **MCQ Section** - 90 minutes, 60 questions, 50% of the exam
- **FRQ Section** - 105 minutes, 7 questions, 50% of the exam, calculator allowed.

FRQ TIPS: Follow the directions 💎 Write out relevant equations 💎 Use proper sig figs 💎 Be confident!